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AUTHOR Derrick, Sara M.; Hock, Ellen
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ABSTRACT

This study compared infants born to narcotic addicted mothers with infants born to nonaddicted mothers and described the potential of an intervention program. Infants of five addicted women were matched with infants of five nonaddicted women on the basis of age and socioeconomic class of the mothers and on the basis of gestational ages, birth weight and Apgar scores of the infants. Data collection and intervention were performed during three time periods. During Phase I addicted women were solicited and interviewed from drug treatment centers for participation. During Pase II mothers were interviewed in hospitals and infants were assessed neurologically and developmentally. Phase III began in the infants' homes at age one week and terminated at age three months. Four types of homemade materials were employed for perinatal education. Pre and post maternal care and home environmental assessments were performed. Infants differed significantly along several dimensions on the basis of maternal addiction status. After intervention infants exhibited increases in alertness, motor maturity, self-quieting behavior, and mean Bayley Mental and Motor scores. (Author/MP)

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INFANTS OF NARCOTIC ADDICTED MOTHERS: DEVELOPMENTAL STATUS, MATERNAL CARE, HOME ENVIRONMENTS AND INTERVENTIVE EFFORTS DURING THE FIRST THREE MONTHS OF LIFE

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Sara M. Derrick
Ellen Hock

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Abstract

This study compared infants born to narcotic addicted mothers with infants born to nonaddicted mothers and described the potential of an intervention program. Infants of five addicted women were matched with infants of five nonaddicted women on the basis of age and socioeconomic class of the mothers and on the basis of gestational ages, birth weight and Apgar scores of the infants.

Data collection and intervention were performed during three time periods: Phases I, II and III. During Phase I addicted women were solicited and interviewed from drug treatment centers for participation. During Phase II mothers were interviewed in hospitals and infants were assessed neurologically and developmentally. Phase III began in the infants' homes at age one week and terminated at age three months.

Four types of materials were employed for perinatal education. They were constructed from scraps of materials found in many homes.

Pre and post maternal care and home environmental assessments were performed.

Infants differed significantly along several dimensions on the basis of maternal addiction status. Infants of addicted mothers performed less well than infants of nonaddicted mothers with thirteen behavioral items:(with habituation to a flashlight and to a bell sound, with orientation to animate and inanimate stimuli, with motor maturity, alertness, cuddliness behavior, activity level, self quieting and hand to mouth behaviors. They demonstrated a higher level of arousal at age three days than did nonaddicted infants.

There were changes in infant behaviors upon termination of intervention. Infants became more alert, exhibited greater motor maturity and more self-quieting behavior. Their mean Bayley Mental and Motor scores increased.

Nonaddicted mothers provided a higher quality of attention directed to their infants than did addicted mothers. Both groups of mothers improved in their caregiving from infant age one week to twelve weeks. Findings with respect to the feasibility of an intervention program offer support for advicating development, implementation and evaluation of aggressive interventive programs for mothers and their infants.

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INFANTS OF NARCOTIC ADDICTED MOTHERS: DEVELOPMENTAL STATUS, MATERNAL CARE, HOME ENVIRONMENTS AND INTERVENTIVE EFFORTS DURING THE FIRST THREE MONTHS OF LIFE

Evidence is available that society has great concern regarding social problems accompanying narcotic addiction by some persons. Much of that concern is reflected in efforts by health professionals particularly, to implement procedures designed to aid pregnant drug addicted women.

Newborn infants of narcotic addicted women represent a group of special interest; such newborn infants, because of their perinatal characteristics, represent a high risk group and are cause for concern upon hospitalization discharge to the mother, in many instances to deprived environments. Infants are sometimes discharged to relatives or voluntarily released by the mother to agencies for temporary or eventual permanent placement.

Before advent of Methadone therapy, follow-up of infants born to narcotic addicted women was infrequent. The first studies of outcome of pregnant addicted women treated with Methadone were reported from Beth Israel Hospital in New York City. Findings from that hospital were that maternal complications were reduced, however there continued to exist a high frequency of low birth weight infants (Zelson, 1973).

Maternal Complications Associated with Narcotic Addiction

Women who present histories of narcotic addiction during pregnancy have been found to demonstrate a variety of unfavorable symptoms immediately following birth of their

infants. Among symptoms reported were hapatitis (Stern, 1966; Schneck, 1958); Blinik, 1969) syphillis (Stone, 1967; Blinik, 1969), post partum psychosis (Krause, 1953) toxemia (Stern, 1966) acute bacterial endocarditis, tetanus and malaria (Moser, 1974). The complication of hepatitis was said to occur frequently in addicts and to be associated with common use of contaminated needles and syringes.

Moser (1974) believed that the medical problem is complicated by total lack of discrimination regarding what some people will pump into a human vein. He said that virtually anything that is rumored to cause a "high" will be reduced to an injectable substance and used by addicts. Rosenow (1974) reported that heroin and other drugs are frequently adulterated with quinine, lactose and talc as well as with baking soda. In a pathetic effort to purify the mixture it may be filtered through cotton and as such, cotton fibres may become lodged in the pulmonary vasculature.

A dramatic position was posed by Moser (1974) in which he noted that perhaps the most serious disease related to heroin use is the state of emotional despair that causes one to elect the personal suffering that accompanies narcotic addiction. It is a disease of society that has been on the scene in one form or another. Whenever men find tedium or frustration of living beyond endurance, some seek escape with nepenthe. He presented negative prognosis for drug addiction as he believes that there is no indication of

closeness to a cure for drug dependency in humans. The aforementioned physicians agree that narcotic addiction during pregnancy and the post partum period presents symptoms within the drug consumer that are potentially harmful and damaging. Thus, pregnant addicts represent an at-risk population for competent societal functioning.

Neonatal Complications Associated with Maternal Narcotic Addiction

Unfavorable neonatal behaviors associated with maternal narcotic addiction are numerous. Prematurity of birth (Cobrinik et al. 1956; Reddy et al. 1971); low birth weight (Cobrinik et al. 1959; Slobody and Cobrinik, 1959; Reddy et al. 1971), high mortality rates (Schneck, 1958; Goodfriend et al. 1956) and lengthy hospitalization periods are frequently found. Wilson et al. (1973) found hyperactivity, brief attention span and temper tantrums. Follow-up studies of surviving prematurely born infants have reported mental and neurological deficit with increasing degrees of prematurity (Caputo & Mandell, 1970). Scott (1972) noted that positive correlation exists between "hard narcotic users" and lowered gestational ages in their infants. He also reported low birth weight among many infants could be due to anorexic effects of narcotic use and poor maternal nutrition. Pierson et al. (1972) found "sudden infant death syndrome." Schneck (1958) found severe excoriations of the infants' heels, nose and other contact

points of the body with mattresses. Other conditions reported were Mongolism (Krause, 1958), Phenylketonuria (Perlmuter, 1967) and respiratory symptoms necessitating oxygen therapy (Schneck, 1958).

Lin-Fu (1969) noted that most infants born to addicted women develop narcotic withdrawal symptoms and approximately between 83 and 91 per cent of such infants are born addicted. There is general agreement among physicians that infants demonstrate withdrawal symptoms: tremor, excessive and high-pitched crying, generalized convulsions, vomiting, anorexia, weight loss, poor feeding, diarrhea, tremulousness and excessive fist sucking (Kundstadter et al. 1968; Cobrinik et al. 1956; Steg, 1957; Schneck, 1958; Stern, 1966; Zelson, 1971). Perlmutter (1967) grouped infant symptoms into several major categories: those referrable to the central nervous system such as marked irritability, excessive crying, sleeplessness, tremors and convulsions; those associated with the gastro-intestinal tract such as vomiting, diarrhea and poor feeding; those related to the respiratory system such as yawning, sneezing, elevated temperatore, excessive perspiration and pallor. Perlmutter noted that it is uncommon for infants to experience no clinical symptoms if the mother is consuming drugs at the time immediately prior to delivery of her infant.

Presence of infant withdrawal symptoms have been attributed to several factors: duration of maternal narcotic ingestion, quantity of consumption and time of intake of

narcotics prior to infant birth. Ingestion of large dosages of narcotics near the end of pregnancy is associated with a likelihood that the infant will be a narcotic addict at birth (Goodfriend et al. 1956). Types of drugs consumed by mothers have been associated with infant illness and withdrawal. Infants of mothers ingesting Methadone in combination with heroin demonstrated greater degrees of illness than infants born to women who ingested heroin alone.

Physicians have not been in agreement regarding effects of Methadone intake during pregnancy. Blatman (1972) believed that Methadone babies are better off than those whose mothers do not ingest Methadone, as therapy due to superior pre and post natal care available . Harper et al (1974) found that a low-dose Methadone program coupled with intense psychological support appears to lessen problems associated with maternal addiction during pregnancy, however withdrawal symptoms continue to be demonstrated in the newborn. Cohen et al (1973) noted that acute symptoms may occur more frequently, last longer and become more difficult to control in infants born to women who ingest Methadone during pregnancy than those born to "street" heroin addicts. Those who oppose Methadone ingestion during pregnancy contend that Methadone is not only addictive to the fetus, but is associated with a high incidence and more prolonged duration of withdrawal

symptoms among newborn infants.

Onset of Infant Withdrawal Symptoms

Cobrinik et al (1959) noted that time of onset of clinical findings in the infant depends on the duration of time the mother has consumed narcotics, type ingested and time of last dose prior to infant birth. He reported that heroin is excreted more rapidly than morphine and therefore one would expect heroin intake to lead to early onset of withdrawal symptoms. In one study Glass et al (1971) found onset of symptoms to vary from immediately after birth to 52 hours of age. Sussman (1973) found symptoms occurring within 12 hours after birth. Several infants were without symptoms. That fact suggests that narcotic addiction in mothers may sometimes not be readily detected.

Prognosis of Addicted Mothers

Douglas (1971) noted that the addicted individual even after withdrawal, detoxification or rehabilitation remains at high risk, in that subsequent intake of drugs even years later, sets up an immediate urge for more consumption. That situation poses a vicious problem in a pregnant woman. She carries a potentially addicted fetus and while detoxification of the newborn seems to be initially a successfully detoxified baby, he is yet an infant with a problem who is released into a disturbed environment where casual exposure to drugs later in life may induce an addictive response. Baer and Corrado (1974) believe crisis

intervention is necessary for addicted pregnant women. Krause (1958) noted that although the prognosis is very poor in heroin addiction, nevertheless he believes that with help from social services and psychiatric intervention during the woman's post partum convalescence some women may be helped to begin leading more productive lives than previously.

Treatment Efforts for Narcotic Addiction

Several physicians (Dole & Nyswander, 1965; Maslansky, 1971; Blinick et al. 1969; Knowles et al. 1971; Kleber, 1971 Hoozerbeth, 1971 and Wallach et al. 1969) reported efforts directed toward aiding drug addicts in the United States. Those efforts include employment of methadone as an interim measure for addicts undergoing treatment. Two types of methadone programs have been employed. The detoxification program is designed to avoid severe symptoms of withdrawal in the addict. Depending on the size of one's "habit" a daily dosage of 20-40 mg. of methadone is provided for the person during hospitalization. Blinick (1967) reported success with the detoxification type of program.

Methadone maintenance programs are aimed at voluntary rehabilitation of the "hard core" addict through gradual methadone ingestion. Gradually increasing dosages are administered daily to induce tolerance. Dosage is increased until an average daily dosage from 80 to 100 mg. is reached. The belief is that at that dosage level narcotic blockage becomes induced and that narcotics become neither necessary

nor desirable and the addict, hopefully returns to a normal and useful life. Several physicians (Knowles et al. 1971; Kleber, 1971; Hoozerbath, 1971; Maslansky, 1971 Dole et al., 1968) favor methadone maintenance programs. Success experienced with physician involvement was a high rate of social productivity, as illustrated by stable employment and responsible behavior on the part of persons who had participated in drug treatment programs.

Developmental Outcome of Infants Born to Narcotic Addicted Women

Several studies have reported behavioral differences between infants born to addicted women and those born to nonaddicted women. Soule et al (1974) compared performance of 19 babies born to women who had ingested methadone during their pregnancy with performance of 41 babies of mothers with no drug intake histories. Infants of narcotic addicted mothers were found to cry more often than infants of nonaddicted mothers. In addition, addicted infants were more tremulous and responded more poorly to visual stimuli than did comparison babies. There was an economic disparity between the two groups of mothers thus precluding study of methadone babies as an isolated clinical problem of drug addiction.

Lessen-Firestone et al. (1974) compared 22 infants of narcotic addicted mothers with 22 infants of nonaddicted mothers. The Brazelton Neonatal Behavioral Scale (Brazelton, 1973) was employed as an assessing instrument and results were reported in terms of four clusters of items. An excitability cluster is composed of items measuring the

infants' arousal level. A passive motor cluster assessed involuntary reflexive motor responses, while an active motor cluster dealt with the infants' self initiated motor movements. A fourth cluster measured two types of cognitive tasks: those measuring response decrement to visual and auditory stimuli and those that assessed orientation to animate and inanimate stimuli. An alertment measure was also obtained. Infants were tested at ages 24 and 48 hours after birth.

Relatively little change in behavior of the infants was found over the 24 hour period. However, a reduction in tremulousness at the 48 hour period was manifested.

Several group effects were found. Addicted infants responded irritably to more stimuli and their behavioral states changed more often than did non addicted infants. There were differences in startles and tremulousness in favor of nonaddicted infants. Addicted infants tended to manifest less mature motor behavior; they were more jerky in their movements and less cuddly than were nonaddicted infants.

Differences in the cognitive-sensory cluster appeared with habituation to a light stimulus. Addicted infants required more trials to cease responding to a light shone over their eyes than did nonaddicted infants. In addition addicted infants were less alert and less available to interaction with examiner than were nonaddicted infants.

Conclusions from this study are important with respect to the mother-infant interactional system. The addicted

infants were less likely to mold and cuddle when held, yet were likely to elicit more caregiving responses from an adult than nonaddicted infants. The addicted infant is likely to tax caregivers' adaptability in providing infant care.

Green (1976) reported data on 32 newborn infants of pregnant addicts who were enrolled in a comprehensive health care program for pregnant addicts and addicted mothers at New York Medical College. Seven of the drug-exposed infants were born prior to completion of the 37th gestational week, 5 were low birth weight. The mothers received regular prenatal care and during at least the last trimester of gestation were administered prescribed methadone in daily dosages of up to 65 mg. Initial management of neonatal withdrawal consisted of frequent feeding at 3-hour intervals and swaddling. Subsequent pharmacological treatment was implemented upon attaining critical levels of severity. The investigators developed an instrument, the Neonatal Narcotic Index, for evaluating withdrawal, which incorporates elements of crying, tremors, muscle tone, respiratory rate, axillary temperature, vomiting and other signs.

Among the 32 infants exposed to narcotics in utero withdrawal was identified in 78 per cent. However, only 16 per cent of the infants required treatment beyond frequent feeding and swaddling. One infant was administered intravenous fluids and electrolytes for management of persistent

vomiting. Others were treated with camphorated tincture of opium, U. S. P. (paregoric). All infants recovered.

Wilson et al. (1973) observed the course of development of 30 infants born to heroin addicts in the environment of a maternity and infant care high risk clinic. Of that number 16 remained in the study for less than one year while the remainder were observed for one year longer. Withdrawal symptoms persisted in 82 per cent of the infants from three to six months. Behavioral disturbances of hyperactivity and growth impairment were demonstrated. Several infants produced growth profiles below the tenth percentile at one or two years of age. The investigators continued to denote concern regarding outcomes of infants of maternal drug addicts and suggested longitudinal study of other groups of similarly addicted infants for data confirmation.

Statement of the Problem

Between 80 and 85 per cent of women addicts are in childbearing age and an increasing number of infants are being born who are exposed to narcotics in utero. Concern among health professionals centers on whether infants born to narcotic addicted mothers escape the environments which produced their mothers and whether a short-term intervention program might make a contribution toward motivating mothers to provide quality caregiving skills to their infants. Accordingly, the purpose of this study was to compare the development of infants born to narcotic

addicted women with infants born to nonaddicted women. In addition, a purpose in this study was to design and determine the feasibility of implementation of a parent-infant educational program designed to promote infant and mother bonding and further, to determine whether changes in maternal care attributes with infants occurred after participation in such a program.

Method

In this study neonatal development and maternal care attributes were compared at several time periods among mother-infant dyads of two groups. One group consisted of infants born to narcotic addicted mothers while a comparison group consisted of infants born to nonaddicted mothers.

Subject Selection

Mothers and their infants participating in this study were selected from three sources. Three women were referred from a drug treatment center in southern Ohio, one was referred from an obstetric clinic and while three were recommended to the study by pediatricians. Seven pregnant women consented to participate in the study. However, two were lost to follow-up and five remained in the study for a three month duration.

Five women who reported no drug ingestion histories consented to participate in the study. Those women are referred to in this study as nonaddicted women. Addicted women and their infants were matched with nonaddicted women

on the basis of their ages and social class positions, gestational ages, birth weights and Apgar scores (Apgar, 1963) of infants

The mean age of addicted women was 24 years, 4 months. The mean age of nonaddicted women was 24 years, 8 months. The women were from low socioeconomic positions with eight of them receiving public welfare support. Mean birthweight of addicted infants was 3,115 grams and of nonaddicted infants was 2,918 grams (Table 1).

Case Histories of Addicted Women

Marital Status

Of the sample of five addicted women, three were single one was widowed, but shared living quarters with her infant's father. One woman was married and lived with her husband and his divorced mother.

Residential characteristics

Addicted women differed with respect to quality of housekeeping and extent of living space that appeared available to them. Case 1 resided in a two-floor house with her two children and a sixteen year old brother, next door to the home of her parents. Her furnishings were deteriorated but seemed moderately clean. Case 2 shared one bedroom which accommodated herself, husband and infant. A drawer from a chest and a wicker basket were used for infant sleeping facilities. The family resided with the infant's paternal grandmother and appeared to have no furnishings of their own. The husband was employed as a supervisor in a local industrial

TABLE 1

DESCRIPTION OF SAMPLE

		Study group N = 5	Comparison group N = 5
Family data:	Welfare supported	4	4
	Father present in home	1	2
	Maternal ages: $\bar{X}$ number of years	24 years, 4 months	24 years, 8 months
	Black women	5	4
	White women	0	1
Infant data:	Gestational ages $\bar{X}$	38.8 weeks	39 weeks
	Birth weight (grams) $\bar{X}$	3115	2918
	Apgar scores (1 minute)	8.6	8.4

setting.

Case 3 lived with her infant and two other children in the home of her parents, together with a teen-age brother. The home interior was always dimly lighted with draperies closed at visitation time. Poor housekeeping standards were evident; roaches were frequently seen crawling on furniture and floors. Exterior of the home was badly deteriorated; steps were difficult to climb due to broken sections.

Case 4 lived in a second-floor apartment situated in a commercial neighborhood. Halls of the building were unclean and dimly lighted. Interior of the apartment was free from debris, but the furniture was worn and soiled. The apartment was dimly lighted, while on occasion a table lamp was lighted with a red bulb. Draperies were always closed during visitation.

Case 5 resided at a "Halfway House" for women until the infant was born. At that time, with aid of the local Welfare Department, she was placed in a first floor portion of a duplex home. The interior was clean and neatly furnished with worn furniture.

Extent of Child Care Provided for Infants by Others

Case 3 relied to a certain extent upon her 14 year old daughter for providing infant care as well as for care of a preschool aged child. Case 4 relied upon her parents to provide care for a nine year old son residing in another city. Case 5 reported that one of her children was cared for by a maternal aunt and another by foster parents. Addicted

women in this study were regarded as "high risk" with respect to resumption of illegal drug use. Rothstein and Gould (1974) noted that addicted women who accept child care services from others are likely to return to illicit drug use and are thus at "high risk" for child rearing.

Maternal Educational Level

All addicted women in this study except one were high school graduates, while two received technical education beyond high school. Neither mother was employed and all received public assistance in varying forms.

Drug Experience

Drug experiences varied among the women. Some cited heroin ingestion as their initial drug involvement, others cited codeine as the first drug of experimentation. Several women were participating in a Methadone Maintenance Program where daily dosages of methadone were administered to them. Psychiatric treatment was also provided to some members at the drug treatment centers.

Receptivity to an Intervention Program

All women in the study were receptive to the program and were cooperative. However, two women were inconsistent in adhering to scheduled appointments. They often eagerly agreed upon time periods but failed to present themselves at appropriate meeting dates.

Data Collection

Data collection was interwoven with intervention activities and was performed during three phases (Table 2).

TABLE 2

DATA COLLECTION SCHEDULE

Phase I--Before delivery	Phase II--After delivery maternity room contact	Phase III--Out patient status throughout the first three months of life							
DATA COLLECTION:		Home and clinic visits							
		Infant ages (weeks)							
1. Parent interview	1. Newborn neurological eval.	H 1	H 2	H 3	CH 4	H 6	CH 8	H 10	CH 12
2. Social class	2. Developmental evaluations	1. Infant developmental 2. Maternal care variables home environment	1. Infant developmental 2. Maternal-infant involvement	1. Infant developmental 2. Maternal-infant involvement	1. Infant developmental 2. Maternal-infant involvement	1. Infant developmental 2. Maternal-infant involvement	1. Medical treatment 2. Maternal-infant involvement	1. Maternal-infant involvement	1. Infant developmental 2. Maternal care variables home environ; medical treatment

H - denotes home based
C - denotes clinic based

Time periods occurred before delivery, during hospitalization following delivery of the infants and during home and Pediatric Clinic visits throughout the first three months of the infants' lives (Table 2).

Phase I--Before Delivery

The investigator visited drug treatment centers, interviewed pregnant addicts and obtained participation consent and demographic data from them.

Phase II--After Delivery and During Maternity Room Contact

Participation consent and demographic data were obtained in maternity rooms from the comparison group of mothers. Infant data were obtained at varying time periods. Apgar Scores were obtained at 1 and 5 minutes. Neurological evaluation of the maturity of the newborns and Brazelton test items were obtained within three days of infant birth. Hospital procedures were followed with respect to attire worn by staff in nursery room areas.

Infant assessments were performed in a small room adjoining the hospital newborn nursery. Beginning the Brazelton assessment while the infant is asleep as recommended in the scale often was not possible, due to the state of arousal of the infants. Administration of the scale provides some flexibility and when necessary, such flexibility was utilized. When, for example, an infant was crying, directions were followed for consoling the infant. When an infant failed to engage in self-quieting behavior, comforting was provided according to

the Scale's Manual. When infants were asleep the Sacle was administered according to standard procedures. Upon completion of assessment the infant was returned to the newborn nursery by a hospital nurse.

Phase III--Out patient Status During the First Three months

Medical surveillance was performed by the Pediatrician who supervised medical aspects of the study, until concern ceased regarding infant withdrawal. At that time and throughout the first three months of life, infants were seen for regular well-baby clinic visits. In addition study staff made home visits on a regularly scheduled basis.

At infant ages one, two and three weeks Brazelton items were administered within infant homes and the same testing procedures utilized in newborn nurseries were employed. Maternal care data were also gathered during the initial home visit, as well as were data which revealed extent of stimulation performed during the infant's home life.

During the first three weeks of the infants' lives intervention was performed by informal discussions with parents and other family members who occasioned to be present at the time. When the infants reached age four weeks play materials were constructed from scraps of paper and were used to enhance infant attention (Figures 1-2). Use of those and similar materials was performed on a bi-weekly basis with each mother-infant pair throughout the remainder of the three month period.

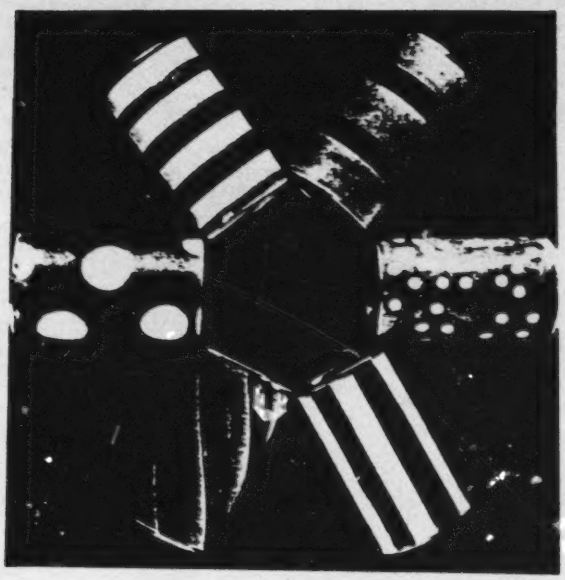


Figure 1. Sample material used for auditory movement stimuli

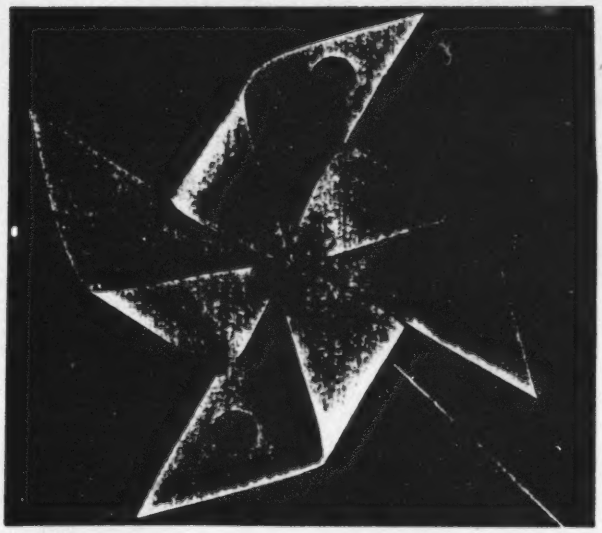


Figure 2. Sample material used for visual movement stimuli

Intervention materials focused on stimulation of three sensory modalities--auditory, visual and tactile. Rationale for material selection and construction derived from studies of infant attention (Fantz, 1958; Wortheimer, 1961; Provence & Lipton, 1962). Infant activities were derived primarily from Gordon (1970 and Cooper (1973).

Infant assessments continued throughout the three month period. The Bayley Mental and Motor Scales were employed when infants reached appropriate ages and again at the completion of the three-month study, when maternal care variables with Ainsworth (1973) categories and Caldwell Home Inventory were again measured.

Data Analysis

Selection of statistical procedures was based on several considerations. In general, for the data yielded by each assessment instrument, that procedure was chosen which facilitated answering the maximum number of questions about the data with maximum power. When an underlying normal distribution of the data could be assumed as with the 27 Brazelton items and Bayley Scales items, parametric procedures were employed.

Data collected with the Caldwell and Ainsworth Scales could not be treated with an underlying assumption of a normal distribution. Mann Whitney U Tests for group differences were selected because of their relative power

to detect group differences.

Results

The purpose of this study was to determine whether differences were found between development of infants born to narcotic addicted women, and development of infants born to nonaddicted women. Specifically the purpose was twofold: (1) to test differences between groups of infants and their mothers and (2) to describe the potential value of an intervention program for addicted and nonaddicted low income women.

No differences were found between neurological maturity at birth of infants born to addicted women and infants born to nonaddicted women. However, it cannot be concluded that narcotic addiction in the mother has no effect on neurological maturity and gestational ages of the newborn infant. Since the physical condition (assessed by the Apgar) of the infants in the addicted group was matched to that of nonaddicted infants by Apgar scores, birthweight and gestational ages, the matching process may thus have obscured such differences if they existed.

Ages of the infants in this study are referenced with four symbols: T_1 refers to age three days; T_2, T_3 and T_4 refer to ages one, two and three weeks respectively. When infant responses with the Brazelton items were examined by the 2 (Group) X 4 (Time) X 27 (Item) mixed model Analysis of Variance with repeated

measures, several differences were found. In addition, significant main effects of the Group, Time and Item, significant Group X Item, and Time X Item interactions were found as shown in Table 3. The null hypothesis of no difference was rejected. The initial analysis was followed by a 2 (Group) x 4 (Time) mixed model Analysis of Variance for each of the 27 behavioral items. A Summary of the significance of effects of Group, Time and Group X Time for the 27 items appears in Table 4.

As seen in Table 4 seven items had only significant Group Main Effects, that is, infants' scores differed only with respect to addiction status of their mothers. Group differences appeared with: Item 1--Response decrement to light, Item 3--Response decrement to bell, Item 6--Orientation response--Inanimate auditory, Item 7--Orientation--Animate visual, Item 9--Orientation--Animate, Visual and Auditory, Item 20--Activity Level and Item 26--Hand to mouth facility. Means for those items are found in Table 5. Addicted infants responded with less mature behavior with each of the above items than did nonaddicted infants. For example, Item 1 may be interpreted: addicted infants continued to respond to presentation of a flashlight over the eyes during ten trials, while nonaddicted infants demonstrated dimunition of response within a range from five to seven trials. The means of the two groups of infants were significantly different and this suggests that infants of

TABLE 3

SUMMARY OF RESULTS OF ANALYSIS OF VARIANCE FOR TWENTY-SEVEN BRAZELTON BEHAVIORAL ITEMS

Source of variation	df	MS	F	Significance
Group	1	161.08	10.78 (1,8)	$p < .05$
Subjects within groups	8	14.94		N.S.
Time	3	20.63	5.48 (3,24)	$p < .01$
Group X Time	3	2.50	0.66	N.S.
Time X Subjects Within groups	24	3.77		N.S.
Item	26	43.11	9.02	$p < .001$
Group X Item	26	19.82	4.15	$p < .001$
Item X subjects Within groups	208	4.78		N.S.
Time X Item	78	1.75	1.59	$p < .01$
Group X Time X Item	78	0.87	.80	N.S.
Time X Item X Subjects Within Groups	624	1.10		N.S.

TABLE 4

SUMMARY OF SIGNIFICANCE OF EFFECTS FOR GROUP X TIME FOR BRAZELTON BEHAVIORAL ITEMS

ITEMS	GROUP	TIME	GROUP X TIME
1. Response decrement to light	$p < .05$	N.S.	N.S.
2. Response decrement to rattle	N.S.	N.S	N.S.
3. Response decrement to bell	$p < .01$		
4. Response decrement to pinprick	N.S.	N.S.	N.S.
5. Orientation response--inanimate vis	$p < .01$	$p < .05$	N.
6. Orientation response--inanimate aud.	$p < .01$	N.S.	N.S.
7. Orientation--animate visual	$p < .001$	N.S.	N.S.
8. Orientation--animate auditory	$p < .05$	$p < .05$	N.S.
9. Orientation--animate. vis./aud.	$p < .01$	N.S.	N.S.
10. Alertness	$p < .05$	$p < .05$	N.S.
11. General tonus	N.S.	N.S.	N.S.
12. Motor maturity	$p < .05$	$p < .01$	N.S.
13. Pull-to-sit	N.S.	$p < .05$	N.S.
14. Cuddliness	$p < .05$	$p < .001$	$p < .01$
15. Defensive movements	N.S.	$p < .05$	$p < .05$
16. Consolability with intervention	N.S.	N.S.	N.S.
17. Peak of excitement	N.S.	N.S.	N.S.
18. Rapidity of buildup	N.S.	N.S.	N.S.
19. Irritability	N.S.	N.S.	N.S.
20. Activity (alert states)	$p < .05$	N.S.	N.S.
21. Tremulousness (all states)	N.S.	N.S.	N.S.
22. Amount of startle during exam.	N.S.	N.S.	N.S.
23. Lability of skin color	N.S.	N.S.	N.S.
24. Lability of states (all states)	N.S.	N.S.	N.S.
25. Self quieting activity	$p < .001$	$p < .001$	N.S.
26. Hand to mouth facility (all states)	$p < .05$	N.S.	N.S.
27. Smiles (all states)	N.S.	N.S.	N.S.

TABLE 5

SUMMARY OF STATISTICALLY DIFFERENT GROUP MEANS FOR THE GROUP X TIME ANALYSIS OF VARIANCE ON ITEMS WHERE GROUP WAS SIGNIFICANT AS A MAIN EFFECT

Items	Addicted Group	Nonaddicted Group	Significance
1	3.95	6.05	$p < 0.05$
3	3.75	5.55	$p < 0.05$
6	3.85	5.75	$p < 0.01$
7	2.60	5.00	$p < 0.001$
9	3.60	5.75	$p < 0.01$
20	6.15	4.70	$p < 0.05$
26	4.10	6.00	$p < 0.05$

narcotic addicted women in this study were less capable of terminating responses to the presentation of a flashlight beam across their eyes than were infants of nonaddicted women. An example of group differences is summarized for Item 1 (Response decrement to light) in Table 6.

TABLE 6

SUMMARY OF RESULTS OF ANALYSIS OF VARIANCE WITH BRAZELTON ITEM 1--RESPONSE DECREMENT TO LIGHT

Source of Variation	df	MS	F	Significance
Group	1	44.10	9.97 (1,8)	$p < 0.01$
Time	3	0.47	0.59 (3,24)	N.S.
Group X Time	3	1.37	1.73 (3,24)	N.S.

Inspection of Table 6 reveals group differences among the infants. A similar interpretation is submitted with respect to Item 3 which measures an infant's response decrement to presentation of sound of a bell within the infant's auditory range. Addicted infants demonstrated less mature abillty than did nonaddicted infants in ceasing their responses to an auditory stimulus.

Items 6, 7 and 9--Orientation responses to inanimate auditory, animate visual and animate--visual and auditory, measure the extent to which an infant alerts toward environmental events--a human face, a ball and sound of a rattle. Infants of addicted mothers oriented toward animate and inanimate objects at lower levels than infants of nonaddicted mothers.

With item 20--Activity--infants of narcotic addicted mothers demonstrated more activity during examining sessions as well as less hand to mouth activity (item 26) than did infants of nonaddicted mothers. Upon stimulation which triggered infant activity, addicted infants were more active during examining periods than were nonaddicted infants.

Group and Time differences as Main Effects were found with respect to five items: Item 5--Orientation Response--Inanimate Visual, Item 8--Orientation-Animate, Auditory, Item 10-Alertness, Item 12--Motor Maturity and Item 25--Self Quieting Activity. With Item 5, for example, group means across four age periods were: for addicted

infants-2.5; for nonaddicted infants-5.15. This means as the examiner moved a bright red ball across the infant's visual field addicted infants stilled, brightened their eyes and made brief following, while nonaddicted infants focused on and followed the stimulus horizontally for at least a 30° arc, thus demonstrating more mature behavior than addicted infants.

An example of Group and Time differences is presented for Item 5 (Figure 3). Both groups of infants increased their levels of performance over time. Scores at age three weeks (T_4) are significantly different from scores at age three days and one week (T_1 and T_2 respectively) $p < .05$.

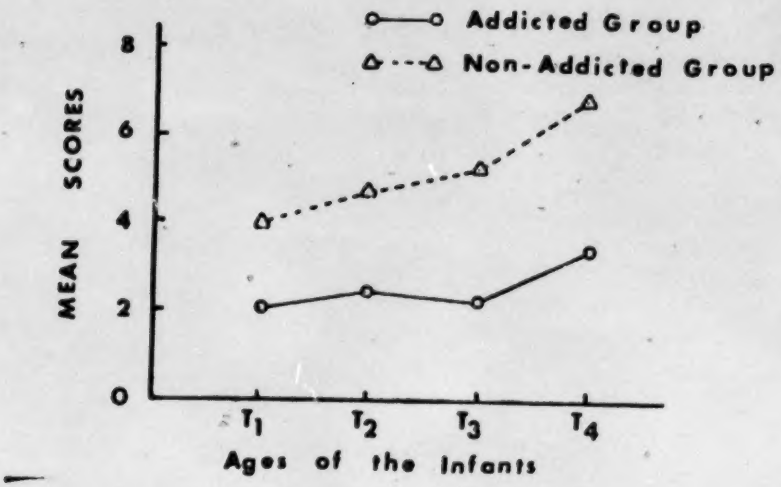


Figure 3. Group Means on Brazelton Item 5, at four age periods

Absence of Group X Time interaction indicates that differences between group means remained constant during

all four time periods. Infant performance with Items 8, 10, 12 and 25 revealed that addicted infants oriented toward the sound of a human voice with less complex behaviors, they were were less alert, they exhibited less motor maturity and were less able to quiet themselves than were nonaddicted infants (Table 7).

TABLE 7

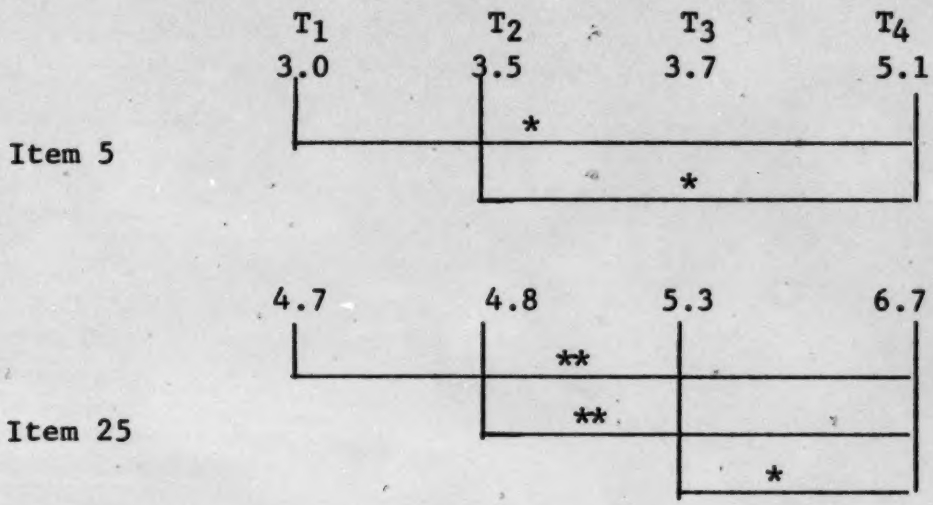
SUMMARY OF SIGNIFICANTLY DIFFERENT GROUP MEANS ON ITEMS WHERE TIME WAS SIGNIFICANT AS A MAIN EFFECT--NO INTERACTION SIGNIFICANCE

Items	Addicted infants	Nonaddicted infants	Significance
5	2.50	5.15	$p < 0.01$
8	3.90	5.80	$p < 0.05$
10	3.25	5.25	$p < 0.05$
12	3.45	4.85	$p < 0.05$
25	4.05	6.70	$p < 0.001$

Inspection of Table 7 reveals that significant differences were revealed between the groups of infants with each of the five items. Those differences were found in favor of nonaddicted infants. A summary of significantly different Group and Time means is presented in Table 8. Pairs of means bracketed and flagged with a single asterisk were found to be different at the significance level, $p<0.05$. Pairs of means bracketed and flagged with a double asterisk were found to be different at the significance level $p<0.01$.

TABLE 8

SUMMARY OF SIGNIFICANTLY DIFFERENT TIME MEANS FOR THOSE ANALYSES OF VARIANCE ON ITEMS WHERE GROUP AND TIME WERE SIGNIFICANT AS MAIN EFFECTS -- NO INTERACTION



* $p < 0.05$
** $p < 0.01$

Time effects only were revealed form Item 13--(Pull-to-sit), a measure of the extent to which the infant rights the head upon being pulled to a sitting position. The following means at each time, across two age groups were found:

T_1	T_2	T_3	T_4
4.5	5.1	5.7	5.7

The above means order themselves over time. T_1 mean is lowest; T_2 is next; T_3 and T_4 are alike numerically. Since means at T_3 and T_4 were alike, they were pooled for a collection of three means, rather than four, upon which a Newman Keuls test for all possible differences was performed. The mean at T_1 was found to be statistically different from means at T_3 and T_4, ($p < 0.05$).

This indicates that changes occurred between age three days and ages three and four weeks with both groups of infants.

At age three days when pulled to sitting position the infants' shoulders and arm tone increased ($\bar{X}$ = 4.5); while in sitting position they lifted their heads. Although they were unable to maintain righting positions, efforts were directed toward accomplishing that maneuver. By the time they had reached age three weeks, they were able to bring their heads to body midline and maintain that position for one or two seconds ($\bar{X}$ - 5.7). No significant group differences were found, however both groups made progressive gains with the Pull-to-Sit item as their ages increased.

Significant effects of Group, Time and interaction of Group and Time were found with Item 14--Cuddliness. That item measures the extent to which the infant cuddles in the examiner's arms when held. Group means at each time are below:

	T_1	T_2	T_3	T_4
Addicted Group	4.60	4.80	4.80	4.80
Nonaddicted Group	5.40	5.40	6.40	6.60

Figure 4 reveals comparisons of the groups of infants over the four age periods. Inspection of Figure 4 shows addicted infants to remain relatively constant in their

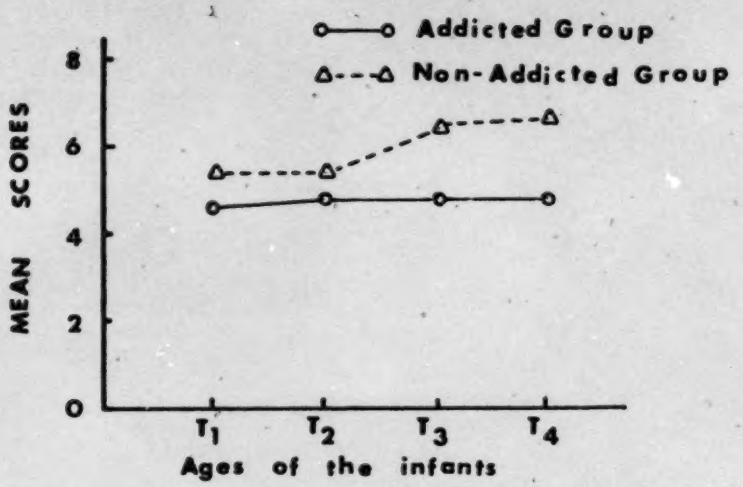


Figure 4. Group Means on Brazelton Item 14--Cuddling behavior, at Four age periods

cuddling and nestling behavior with the examiner while nonaddicted infants increased their level of cuddling behavior. In general, addicted infants demonstrated less cuddling behavior than nonaddicted infants.

At age three days addicted infants were able to mold in examiner's arms, but only after a great deal of cuddling and nestling encouragement by examiner. Nonaddicted infants, on the other hand usually molded and relaxed initially upon being held. They nestled the head in the elbow of examiner; when placed in vertical position at the shoulder they appeared to lean forward. Little change was demonstrated over time in cuddling behavior of addicted infants.

Brazelton Item 15 measures the extent of defensive behavior demonstrated by infants in attempting to remove a cloth held on the upper portion of the face. Results of Analysis of Variance revealed that significant differences

between infant groups with respect to that behavior were inconsistent with advancing age (Figure 5).

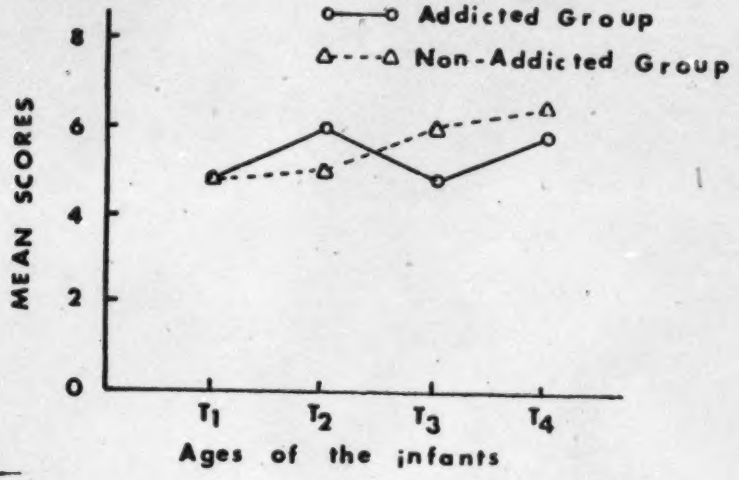


Figure 5. Group Means on Brazelton Item 15--Defensive movements, at Four age periods

Inspection of Figure 5 indicates that direction of group differences is not the same at T_2 where the addicted group seems superior, as at T_3 and T_4 when the nonaddicted group is revealing greater defensive behavior. Although group differences were not significant at either time, the cross-over directions of differences probably accounts for the significant Time interaction.

On the basis of findings of significant differences on behavioral items from the Brazelton items, the null hypothesis of no differences was rejected with respect to behavioral aspects of addicted and nonaddicted infants.

Further infant analysis with the Bayley Scales of Infant Development (Mental and Motor Scales) was performed at ages 2 and 3 months. Use of a 2(Group) X 2 (Time) mixed model Analysis of Variance yielded no significant group differences at either chronological age with the Mental or Motor Scale. However, both groups of infants increased their scores ($p < 0.01$) with the Mental and Motor Scales between the two testing sessions.

In addition, Bayley Mental Scale scores revealed group differences on the Visual Following skills in favor of nonaddicted infants. Those infants demonstrated more mature visual tracking of objects than did addicted infants.

Maternal Caregiving and Home Environment

Scores on the Ainsworth Maternal Caregiving ratings were obtained, reflecting behavior of both groups of mothers who were observed at two time periods (infant ages one and twelve weeks). Mean scores are presented in Table 9. Data derived from use of the Ainsworth Scales were analyzed with a modified two-sample t-test. A modofied t-test protects probability levels if the variance (as it was in this case) cannot be assumed to be homogeneous. The probability level is, strictly speaking, correct only if one rather than a large number of tests were performed. However, that observed differences are all in the expected direction (i.e., in favor of nonaddicted mothers), lends support to the belief that differences found are reliable.

TABLE 9

Group Means on Ainsworth Maternal Care Scales

		Time of Assessment					
		1 week Assessment			12 week Assessment		
		Addicted	Non-Addicted	* Statistical Significance	Addicted	Non-Addicted	*Statistical Significance
Mother's Delight in Baby	Mean	3.4	7.4	$p < 0.05$	5.8	9.0	$p < 0.05$
	S.D.	2.6	1.7		2.3	0.0	
Amount of Interaction	Mean	3.0	7.8	$p < 0.05$	5.4	8.6	$p < 0.05$
	S.D.	2.0	1.8		3.0	0.9	
Appropriateness of Initiation of Interaction	Mean	3.4	7.0	$p < 0.05$	5.4	8.6	$p < 0.05$
	S.D.	2.2	2.0		3.0	0.9	
Mother's Availability to Baby	Mean	3.8	7.8	$p < 0.01$	5.4	8.6	$p < 0.05$
	S.D.	1.8	1.1		3.0	0.9	
Mother's Acceptance of Baby	Mean	5.0	7.4	$p < 0.05$	7.0	9.0	$p < 0.05$
	S.D.	1.4	1.7		1.4	0.0	
Mother's Perception of Baby	Mean	4.2	5.4	N.S.	6.2	8.6	$p < 0.05$
	S.D.	1.1	1.7		1.8	0.9	

* Determined by modified two-sample "t" tests

As rated by these scales, nonaddicted mothers provided a higher quality of attention directed to their infants than addicted mothers. Also of interest is the fact that both groups of mothers improved in their caregiving from infant age one week to twleve weeks (Table 9).

Information obtained from the Caldwell et al Inventory of Home Stimulation was divided into six categories. Scores for mothers in both groups are presented in Table 10. When Mann Whitney U tests were applied to determine significance of group differences, it was determined that two different category scores assessed at one week infant age were significantly different. At infant age one week nonaddicted mothers expressed less inclination to utilize negative means (restriction and punishment) to "control" their infants' behavior than did addicted mothers. As well, nonaddicted mothers were more involved in their infants' on-going activities.

Discussion

Results of this study with respect to infant performance on Brazelton items (habituation and orientation) support findings from other studies (Strauss et al., 1975; Soule, et al., 1976). It is evident that response decrement is difficult to produce in infants of narcotic addicted women, especially when presented with visual and auditory stimuli representing Brazelton tasks.

Orientation responses on the Brazelton Scale are scored in terms of alerting eye movements and head turning with

TABLE 10

Group Means on the Caldwell et al., Inventory of Home Stimulation

		Time of Assessment					
		1 week Assessment			12 week Assessment		
		Addicted	Non-Addicted	*Statistical Significance	Addicted	Non-Addicted	*Statistical Significance
Emotional and Verbal Responsivity	Mean	6.4	7.8	N.S.	6.8	9.0	N.S.
	S.D.	2.4	0.8		2.3	1.2	
Avoidance of Restriction and Punishment	Mean	5.4	6.0	$p < 0.05$	5.6	6.0	N.S.
	S.D.	0.5	0.0		0.5	0.0	
Organization of Physical and Temporal Environment	Mean	2.8	3.0	N.S.	4.4	4.4	N.S.
	S.D.	0.8	0.7		0.5	1.1	
Provision of Appropriate Play Materials	Mean	0.0	2.0	N.S.	2.2	4.6	N.S.
	S.D.	0.0	2.3		1.9	2.1	
Maternal Involvement with Child	Mean	1.0	3.2	$p < 0.05$	3.6	4.6	N.S.
	S.D.	0.7	1.8		2.1	2.1	
Opportunities for Variety of Daily Stimulation	Mean	1.4	2.4	N.S.	1.6	2.8	N.S.
	S.D.	1.3	1.1		1.5	0.8	

*Determined by Mann-Whitney U Tests

stimulus presentations. Brightening of eyes is regarded as evidence of infant attention to stimuli. Lewis (1974) regarded attention as a measure of mental processes vital for intellectual growth. He suggested that the rate of response decrement and infant attention to stimuli may be regarded as indicators of central nervous system functioning. On that basis it is important to consider the possibility that differences in central nervous system functioning may have contributed to differences between groups of infants in this study, particularly with respect to habituation and orienting behaviors. Further research may provide more definitive data with this concern.

Drug-exposed infants were more active during examining sessions than were nonexposed infants and were less able to employ hand-to-mouth maneuvers for self consoling. Unexposed infants cuddled in the arms of examiner more readily than did drug-exposed infants, and were more able to engage in self-quieting activities. As the infants increased in chronological age, unexposed infants became better able to nestle and cuddle, whereas the drug-exposed babies remained "non-cuddly." Findings regarding cuddling behaviors are particularly interesting because of their obvious implications for quality of a developing mother-infant relationship. From birth the drug-exposed babies were judged to be less cuddly than non-exposed babies. Thus, perhaps their contribution to the mother-infant relationship could be characterized as less likely to elicit maternal nurturing.

It should be noted that findings with respect to maternal characteristics revealed that addicted mothers were less inclined to interact sensitively with their babies. Thus, it is not likely that those mothers persisted in trying to accommodate to contact needs of their non-cuddly babies. The salient cause-effect relationship is unknown. Does a non-cuddly baby elicit insensitive mothering, or does insensitive mothering hinder development of appropriate cuddling skills? Both forces may be at work. Further investigation should be directed toward isolating and clarifying forces that impinge upon the infant-addict mother relationship. This line of investigation could result in very useful findings related to policies and programs aimed at improving quality of life for infants who are born to narcotic addicted mothers.

Mean Bayley developmental scores of the two groups of infants were not significantly different. It may be that notable differences in infant functioning after exposure to narcotics in utero compared to those unexposed exist in discrete signs traditionally viewed as signifying neurological impairment. The global Bayley scores may not be useful in discovering differences of this nature.

Th examine the soundness of this interpretation, scores were analyzed separately on the "Visual following" items from the Bayley Mental Scale (i. e., ten items assessing coordination of eye movements with bright colored objects propelled vertically, horizontally amd circularly and visual

following of a moving person). Those test items, when administered at eight weeks of age, were thought to represent a more sensitive assessment of neurological functioning than a global developmental quotient score. Application of a one-way Analysis of Variance to the data revealed a statistically significant group difference, with the unexposed infants earning successes with more items than the exposed group. This finding, based on Bayley items, when considered along with results of the four early Brazelton assessments, provides evidence that the group of infants exposed to narcotics in utero functioned less well throughout the first eight weeks of life than did the matched comparison group of unexposed infants. It is thus apparent that data derived from serial assessments using the Brazelton Scale early in life, followed by other sensitive measures of neurological functioning, provide a useful profile of developmental progress of high risk infants, especially those born to mothers who demonstrate histories of drug ingestion during pregnancy.

Findings with respect to the feasibility and effectiveness of the model intervention program offer support for advocating development and evaluation of aggressive intervention programs. Evidence for positive effects (health care and home based parent education for infant well being) is derived from the general improvements in functioning of mothers and infants in both groups during intervention.

Since treatment was provided for both groups of mother-infant dyads, generalizations are not submitted that all

positive changes were due solely to the intervention process. The results do provide evidence about problems associated with maternal narcotic addiction and new born infants who may be at risk for development in relation to narcotic exposure in utero. Some maternal behaviors were not measured in this study, especially those associated with maternal spontaneous interactions with their infants, such as the process of shaking a bunch of keys or tapping a metal object for sound production in order to elicit infant responsivity. The program was exploratory however the authors believe it has merit for program planning and further research.

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